Circadian rhythm of Glomerular filtration (GFR) rhythm and sodium-excretion in children with enuresis

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Introduction

Nocturnal diuresis is subtyped in non-monosymptomatic enuresis **(NMNE)** with evidence of underlying bladder dysfunction and monosymptomatic enuresis **(MNE).**
It is accepted that nocturnal polyuria **(NP)** plays a major role in MNE. Although nocturnal polyuria can largely be explained by abnormalities in circadian rhythm of vasopressin, other circadian rhythms in the kidney might be involved.
Recently disturbed day/night rhythms of blood pressure, prostaglandins , solute excretion and GFR were documented in refractory patients.

Aim

Explore the importance of abnormal circadian rhythm of glomerular (GFR) and tubular (sodium, potassium) parameters in patients with MNE, compared with children documented bladderdysfunction (NMNE) as underlying cause.

Method

Retrospective study

- Standardized screening (ICCS questionnaire)
- 14 days diary for nocturnal enuresis and diuresis
- 24h concentration profile: diuresis- volume,- rate, excretion of sodium, potassium, osmolality, creatinin
- Mineralocorticoid effect (UK/(UNa+K))
- Circadian rhythm of creatinin excretion with calculation
  1. % creatinin excretion collection / 24h creatinin excretion
  2. creatinin mg/min

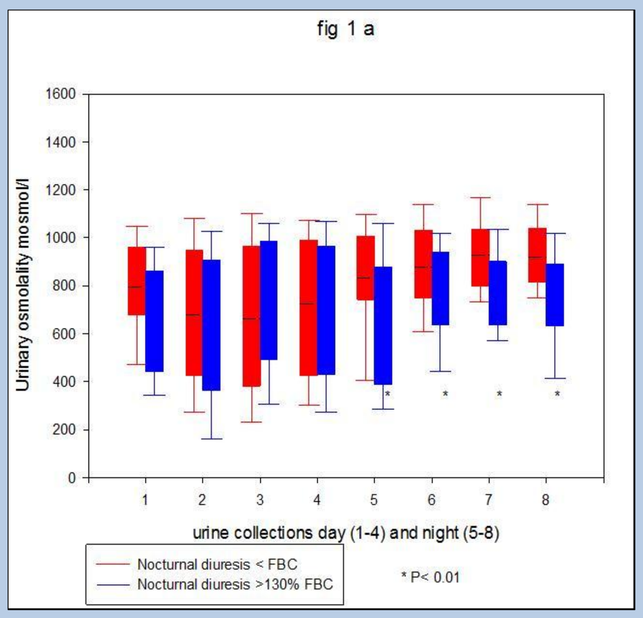
Study population
139 children (> 5 years old) with nocturnal enuresis (NE).
Tertiary enuresis population (UZ Gent). ♂ 65 %/♀ 35%
58% MNE/42% (NMNE)

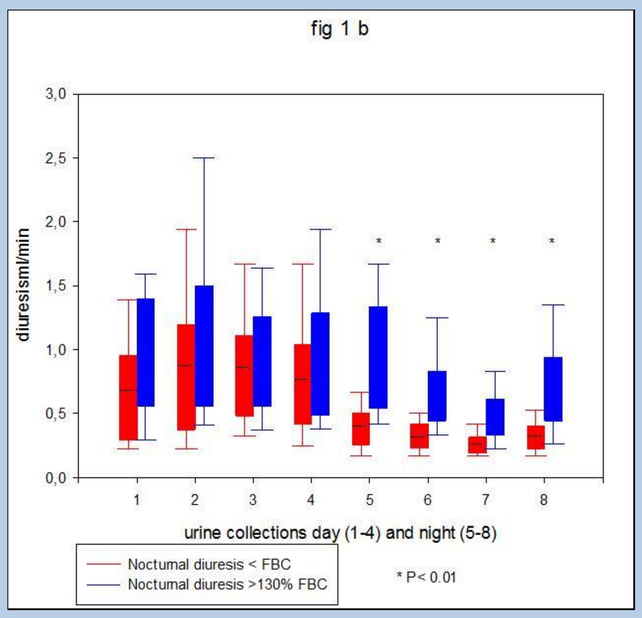
Question 1 : Are there differences in circadian rhythm between MNE and NMNE?
Question 2: Are there differences between presence of NP (nocturnal diuresis > 130% FBC) (n = 46) or absence of NP (nocturnal diuresis < 100% FBC) (n = 46)?

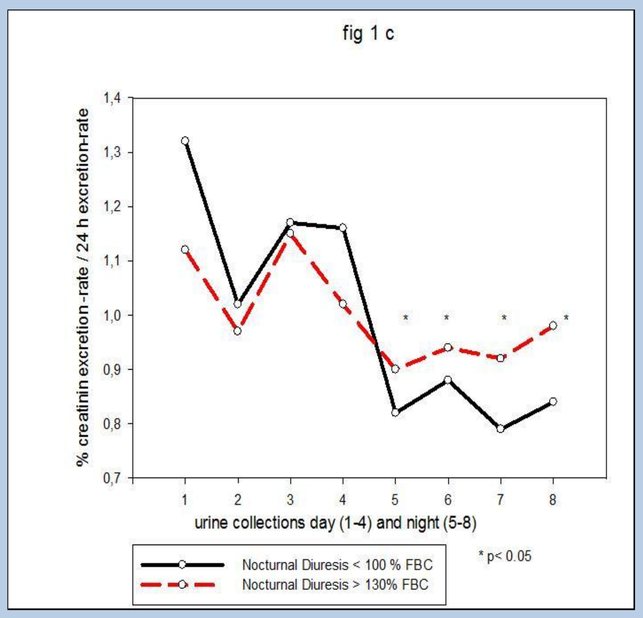
Results

1. Maintained circadian rhythm of GFR, sodium,osmotic excretion and diuresis rate in both children with MNE and NMNE ($p<0.01$). No significant difference between the two groups.

2. In patients with nocturnal polyuria(> 130% FBC) compared to patients with nocturnal diuresis < 100% FBC (both with MNE and NMNE), not only circadian rhythm of urinary osmolality and diuresis but also creatinin excretion (GFR) are lost. **(Fig 1)**
This is related to abnormal circadian rhythm of solute and sodium excretion, but not of potassium nor mineralocorticoid effect. **(Fig 2)**







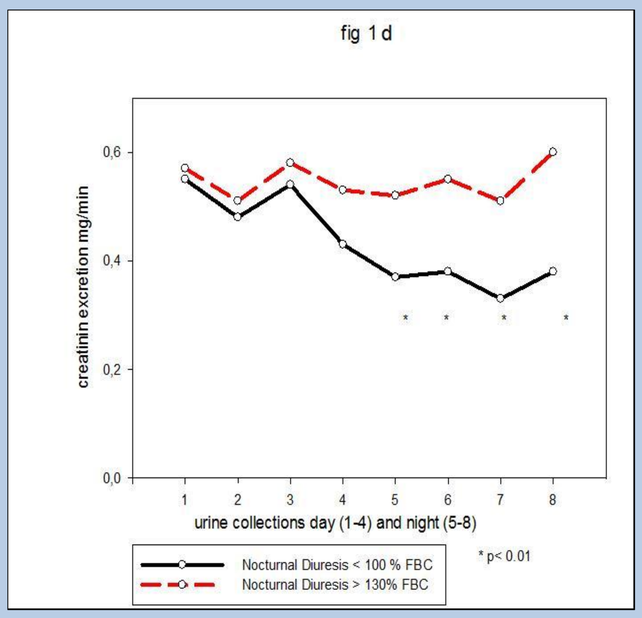
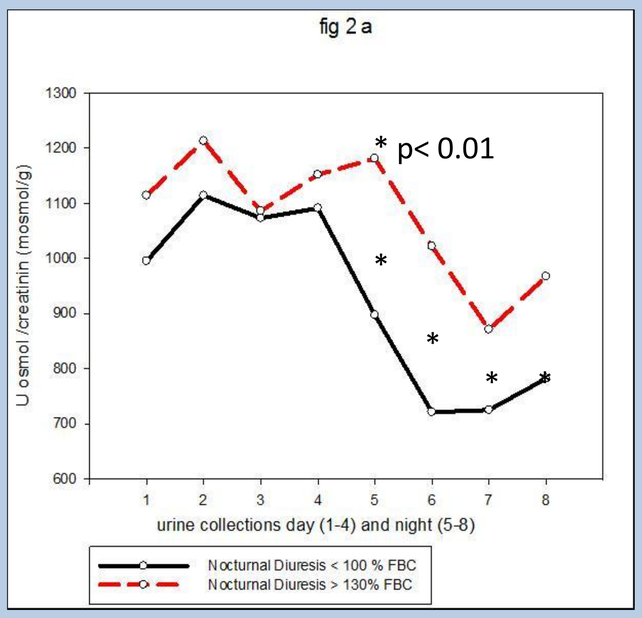
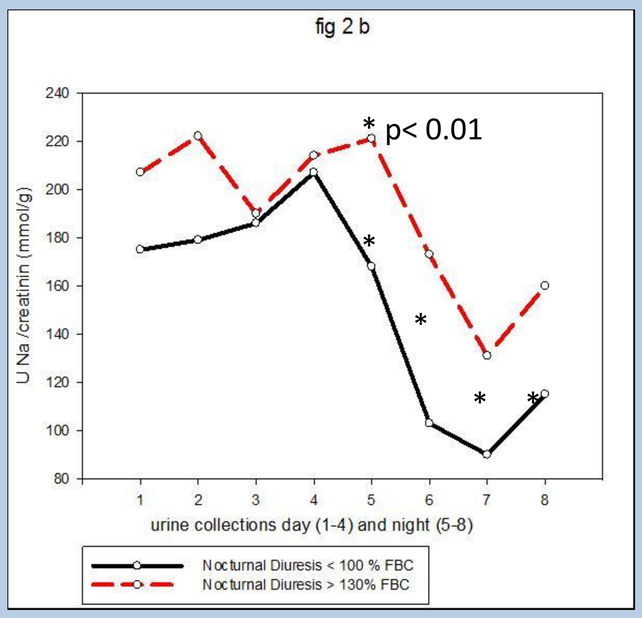
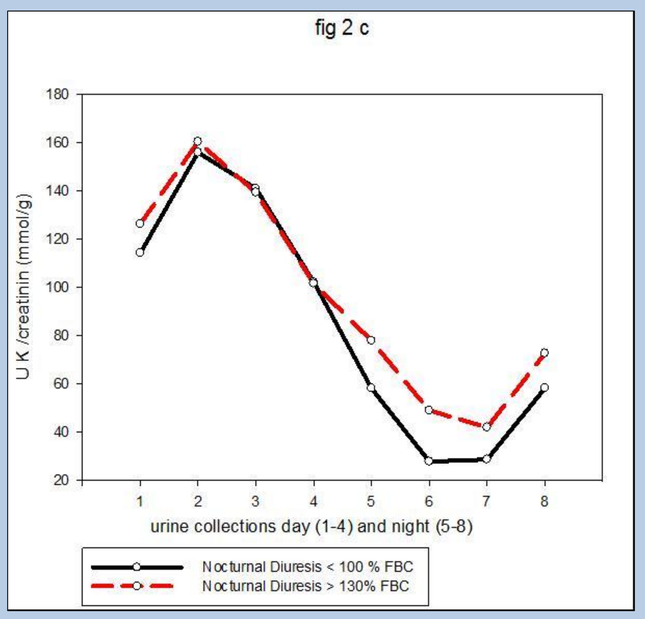


Fig 1: Circadian rhythm of concentrating activity (urinary osmolality) **(Fig1a)**, diuresis rate **(Fig1b)**, creatinin excretion expressed as % of 24 hours excretion **(Fig 1c)** and creatinin excretion/min **(Fig1d)**







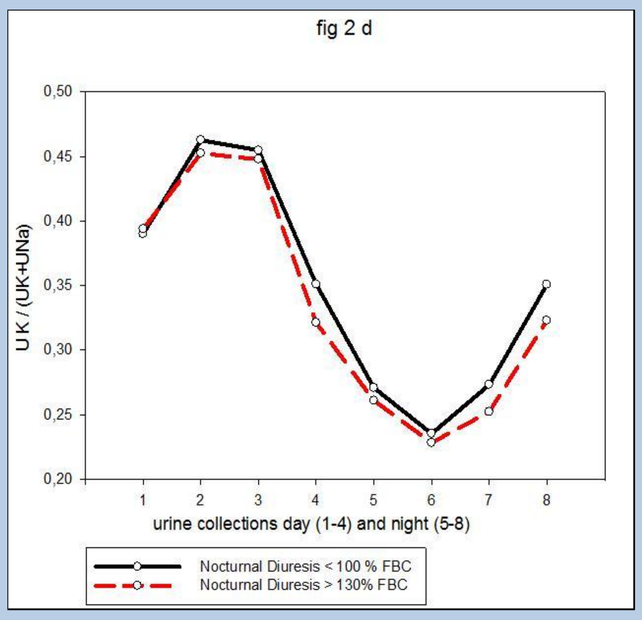


Fig 2: Children with nocturnal polyuria (defined as > 130% FBC age) versus children without nocturnal polyuria (nocturnal diuresis volume < 100% of the FBC age (Hjalmas formula))

CONCLUSION

Circadian rhythm of the kidney is not different between NMNE and MNE.
The subgroup of enuresis with NP have a diminished circadian rhythm of nocturnal diuresis, sodium-excretion and GFR in contrast with children without NP. This observation can not be explained by the vasopressin theory.